Abstract View

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The Annual Rossby Wave in the Central Equatorial Pacific Ocean

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ABSTRACT

We attribute observed annual variations in the subthermocline thermal structure of the central equatorial Pacific to a forced gravest-meridional-mode Rossby wave. In the region between 300 and 800 m (where the Väisälä frequency varies slowly and has an average value of 3.46×10^{-3} s^{-1}), the annual phase of dynamic height propagates upwards at about 6.3×10^{-5} m s^{-1}, and the calculated equivalent depth is 12.3 ± 3.4 cm. The meridional structure of the annual temperature harmonic amplitude near 450 m is consistent with that of the gravest Rossby wave with an equivalent depth of 14.0 cm. The annual period zonal wind stress over the equatorial Pacific Ocean propagates to the west at about 40 cm s^{-1}, which is the same speed at which the annual thermocline depth fluctuations move westward. For the implied zonal wavenumber, the Rossby wave dispersion relation yields a third estimate of equivalent depth, 15.1 cm. A relative maximum of the annual zonal wind amplitude in the eastern central Pacific probably accounts for the deep (450 m) maxima observed in annual temperature amplitude. The Rossby wave provides a mechanism by which wind energy at annual period can enter the deep equatorial Pacific Ocean, and seems to account for the observation of an annual cycle in deep zonal current in the western Pacific by Eriksen.